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## EUROPEAN PATENT APPLICATION

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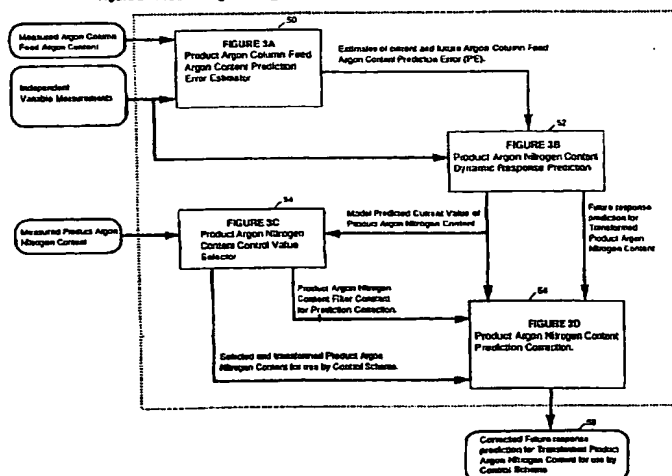
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## (54) Model predictive control method for an air-separation system

(57) A cryogenic air separation process generates both an intermediate product and an output product. The intermediate product is produced earlier in time than the output product and variations in output product measurements correlate to earlier variations in intermediate product measurements. The process responds to plural independent variable phenomena. The apparatus includes analyzers for providing measures of the intermediate and output products and the independent variable phenomena. A control processor predicts a

measure of the intermediate product, based on the independent variable phenomena and output predicted values therefor. A difference is then determined between the current predicted value for the intermediate product and a measure of the intermediate product, to arrive at a prediction error. The processor is responsive to this intermediate product prediction error to further predict both current and future values of the output product so as to enable control actions to be taken with respect to the output product to control impurities therein.

Figure 3 - Product Argon Nitrogen Content - Response Prediction Method.



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# EUROPEAN SEARCH REPORT

Application Number  
EP 95 11 2775

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	CHEMICAL ABSTRACTS + INDEXES, vol. 110, no. 10, 15 May 1989, page 165 XP000017004 KASHIWABARA YOSHIYUKI ET AL: "CONTROL OF NITROGEN CONCENTRATION IN ARGON-CONTAINING GAS FOR ARGON PRODUCTION" * abstract *	1,9,10	G05B13/04 F25J3/02 F25J3/04
A	EP-A-0 321 163 (AIR PRODUCTS AND CHEMICALS INC.) * page 6, line 11 - page 10, line 2 *	1,9,10	
A	EP-A-0 508 386 (UNION CARBIDE INDUSTRIAL GASES TECHNOLOGY CORPORATION) * page 6, line 8 - page 11, line 25 *	1,9,10	
A	US-A-4 707 786 (G. DEHNER) * column 6, line 56 - column 7, line 44; figure 3 *	9	
A	EP-A-0 377 913 (THE BOEING COMPANY) * claim 1; figures 1-5 *	9	TECHNICAL FIELDS SEARCHED (Int.Cl.6)
A	PATENT ABSTRACTS OF JAPAN vol. 7, no. 105 (P-195) [1250] , 7 May 1983 & JP-A-58 027203 (TOKYO SHIBAURA DENKI K.K.), 17 February 1983, * abstract *	10	G05B F25J
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 24 April 1996	Examiner Goetz, P
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- & : member of the same patent family, corresponding document	

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**CLAIMS INCURRING FEES**

The present European patent application comprised at the time of filing more than ten claims.

- ☐ All claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for all claims.
- ☐ Only part of the claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid,  
namely claims:
- ☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

**LACK OF UNITY OF INVENTION**

The Search Division considers that the present European patent application does not comply with the requirement of unity of invention and relates to several inventions or groups of inventions,  
namely:

see sheet -B-

- ☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- ☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respects of which search fees have been paid,  
namely claims:
- ☐ None of the further search fees has been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims,  
namely claims:



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**LACK OF UNITY OF INVENTION**

The Search Division considers that the present European patent application does not comply with the requirement of unity of invention and relates to several inventions or groups of inventions, namely:

1. Claims 1-8: Control method for a cryogenic air separation system using predictors
2. Claim 9 : Control method for a cryogenic air separation system using a filter
3. Claim 10 : Control method for a cryogenic air separation system using a predictor and selecting the output according to preset limits